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June 21, 1994

JUN 21 1994

Mr. William F. Caton, Acting Secretary
Federal Communications Commission
1919 M Street, N.W., Room 222
Washington, D.C. 20554

FEDERAL COMMUNICATIONS COMMISSION
OFFICE OF SECRETARY

EX PARTE

Re: PR. Docket No. 93-61

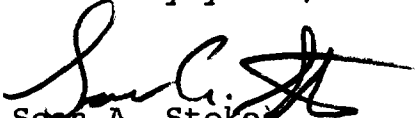
Dear Mr. Caton:

Pursuant to Section 1.1206(a)(1) of the Commission's Rules, this is to notify you that on June 17, 1994, the Utilities Telecommunications Council (UTC), made a written ex parte presentation to the Office of Chairman Hundt.

The written presentation describes Southern California Edison's "NETCOMM" Communications System that has been developed to operate in the 902-928 MHz band. A copy of the presentation is enclosed.

Should any questions arise concerning this notification, please communicate with the undersigned.

Cordially yours,


Sean A. Stokes
Senior Staff Attorney

cc: Gia Lee
Public Inspection File

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**SOUTHERN CALIFORNIA EDISON'S
NETCOMM COMMUNICATION SYSTEM**

**SPENCER T. CARLISLE
SOUTHERN CALIFORNIA EDISON COMPANY**

JUNE 1991

INTRODUCTION

For the past five years Southern California Edison Company (Edison) has been developing and testing a multi-purpose, two-way Packet Radio communication system for remote metering and distribution automation functions. The system was designed with the objective of communicating in a quasi-real time manner with millions of customer meters, load controllers and other apparatus to operate the distribution system in a more reliable and efficient manner. Netcomm is not designed to replace high-speed data links such as fiber optic and microwave. Rather, it is used to provide the communication links to automate the multitude of tasks found in the electrical distribution and secondary service systems which are primarily manual today.

The hardware and software have been developed under an R&D contract and close working association with Metricom, Inc., Campbell, California. Networks totaling approximately 500 packet radios and 1200 solid state electric meters are operating in various Edison service regions covering several thousand square miles stretching from Santa Barbara to Huntington Beach.

Edison has identified greater than 40 applications for this technology which it believes to be commercially viable - ranging from remote meter reading and load control to monitoring and controlling voltages on the distribution system. Edison is highly encouraged by the progress in the development of the NetComm system and plans are underway to install systems for commercial use. The subject of NetComm covers many topics. The following discussion will focus on the design features and operation of the NetComm packet radio system.

THE PACKET RADIO NETWORK

NetComm's radio network uses packet switching to establish reliability through redundancy. Rather than rely on the dependability and perfect working order of all the elements in a single communication line, such as a telephone connection, packet switching relies on multiple communication paths. This ensures that, if some of the paths are blocked or equipment damaged, there will be alternate paths for the message to get through.

A NetComm "packet" is a short burst of digital information which may contain from 1 to 207 bytes of information. In addition to data (e.g., a meter reading or a control signal) each packet carries other information used for error detection, destination and priority routing, time stamping, etc.. Packets can travel over a variety of media. In NetComm the packet radio is the basic building block and it can communicate over radio frequency, power line carrier current and hard wire (RS232).

The packets of information are transmitted, received, and retransmitted (switched) by the low-power packet radios operating in the 900 MHz band. These radios pass the packets from one to the next in a "bucket brigade" or "hot potato" fashion.

Radios are typically installed and powered on distribution transformer's low-voltage secondaries. Radios transmit packets to and from meters and other devices using relatively high frequency power line carrier current. Radios are also linked to computers and other apparatus as mentioned above.

A radio and all the meters and other devices served by one distribution transformer form a "local area network" (LAN) as they communicate with one another over the secondaries. The radios also form a grid-like "wide area network" (WAN) and shuttle packets via RF over longer distances within the service area; for example, from a central computer to an electric meter and back.

Each radio constantly listens for packets addressed to it, or to more distant radios for which it can act as an intermediate repeater. The packet processing time in each radio is on the order of 0.7 seconds. Thus, the total turnaround time for a message to travel from its origin to its destination and back is dependent on the number of radios the packet must travel through, the message priority and the traffic on the system.

PACKET RADIOS

The current generation radio being used by Edison is now considered to be a commercial product and has been in use in demonstration projects for almost two years. Some of the more interesting features of the radio are described as follows:

- O The packet radio received certification by the Federal Communications Commission in March 1990 under Part 15 Rules which were adopted in May, 1986 and revised July, 1990. The radios can be used anywhere in the United States without the need for licensing.
- O Each radio has two communication "domains":
 - 1) A wide area network is used for communicating over long distances (radio-to-radio) via RF in the 902 to 928 Mhz band at 9600 bps. Each radio can "keep track of" approximately 300 other radios in its vicinity.
 - 2) A local area network is used for communicating over short distances by direct connection using RS232 for connection to computers, remote terminal units, etc. at 9600 bps (or) carrier current (center frequency of 230 kHz) for communicating with electric meters and other devices over existing low voltage service wires at 1200 bps.

- O In the RF domain each radio "frequency hops" over 240 channels at 0.70 seconds per hop using a programmable, independent, pseudo-random pattern. Statistically, for every 240 radios, no two will ever be on the same frequency at the same time. This allows for multiple communications to be carried on at the same time in the area. This feature makes the network highly immune to interference and eaves dropping.
- O The RF power is kept to a maximum of 100 milliwatts. The range (radio-to-radio) is typically one to five miles. In line-of-sight situations packet radios are reliably communicating up to thirty miles.
- O Packet protocol is used throughout the network and all communications are essentially 100% error free. There is no forward error correction used in the network.
- O The radio-to-radio routing method is based solely on the geographic address (latitude and longitude) of each radio which is electronically implanted into non-volatile memory at the time of installation. Each radio individually determines where the packet should be sent next - either to another radio for moving the packet to its final destination or to a device attached to that radio on the local area network.
- O The packet radio contains a switching type power supply which can be operated with a variety of common ac or dc voltages. Mobile radios and solar powered repeaters are operated using 12 volt batteries. The radio also has an internal battery charging circuit for powering battery backed radios.
- O An important design criteria for the network has been in the area of time keeping. This is to insure that all devices such as meters and remote terminal units can be consistently maintained for purposes such as time-of-use rates, event recording, etc., and that the customer's "time" matches the utility's time. Testing over the past 18 months has shown that all devices in the network can be time stamped with an accuracy approaching +/- 2 seconds from WWV. The "master" time keeper is generally maintained at only one head end location within the network.
- O Another important criteria has been to use the network in a "broadcast" mode for sending commands or other information to a large number of points for controlling loads, sending price signals, etc. Two varieties of protocols have been developed for this. One termed "Scram Mode", can reach hundreds of thousands of devices in seconds from a head end computer and behaves similarly to presently used (one-way) air conditioner and water

heater cycling systems. The other protocol is termed "broadcast mode" and can reach thousands of devices in minutes (instead of seconds as in the scram mode). This protocol allows complete verification of the message getting to its destination.

HEAD END SOFTWARE

For the past three years a continuing effort has been applied to developing head end software for the NetComm system. The software can be grouped into three broad categories:

- O Software related to the operation and maintenance function allows users to check the status of packet radios and run a wide variety of network diagnostics and performance tests. These can be run in the "background" while the network operates normally. This software is geared to the more technically oriented who have an understanding of the network's operation.
- O Software which is tied to automation functions and SCADA type applications which can interface with Edison's existing power management systems.
- O Software which is "user friendly" and can be run by district operations personnel for on-line transactions such as meter reading, service turn on/turn off, billing inquiries etc.

FUTURE NETCOMM PLANS

One advantage of the NetComm communication technology is that it is modular and very easily expanded. Networks installed in one area for certain functions will automatically link to other networks in adjoining areas which may be installed in the future. As equipment costs decline with volume production and integration, more applications can be added and more of the service territory is covered. This has been loosely termed the "paint-by-number" approach and depicts the way in which Edison plans to install the system commercially.

Edison has thus far identified over 40 applications for NetComm technology which it believes will be commercially viable. As more users within Edison become familiar with the capabilities of the network, the larger the list has grown. A few of the near term high priority applications which are nearing implementation are as follows:

- O NetComm meters and packet radios will be installed at large three phase customer locations which require sophisticated metering systems.
- O Packet radio networks and meters will be used for

difficult to read and isolated areas.

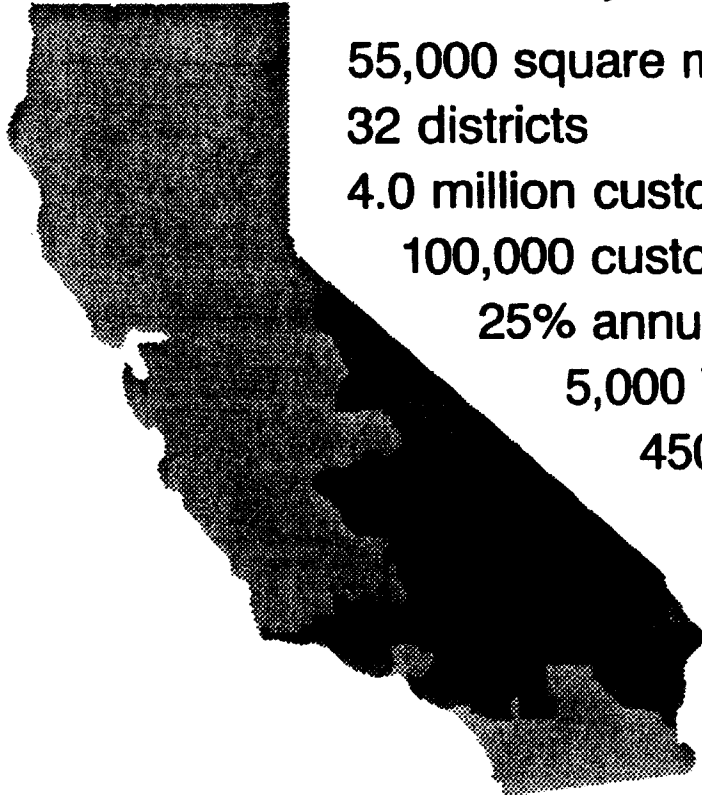
- O The status of automatic reclosers (approximately 850) will be remotely monitored with packet radios.
- O Packet radios networks with the multi-function solid state meters will be used for remotely monitoring circuit voltage profiles.
- O Switched capacitor banks will be monitored and controlled over the network.
- O Packet radios will be interfaced with rtu's and installed at Edison's telecommunication sites for trouble and alarm reporting.

FOOTNOTE

Southern California Edison and the author would like to express appreciation to Pacific Gas and Electric, Boston Edison, Florida Power & Light, Public Service Electric & Gas, Iowa Public Service, and Puget Power & Light for their contributions in helping to make Packet Radio Communication a success by their efforts in demonstrating this technology on their systems.

Southern California Edison

System Characteristics



55,000 square mile service territory

32 districts

4.0 million customers

100,000 customers/year growth

25% annual customer turnover

5,000 Time-of-Use customers

450,000 demand metered customers

130,000 customers on direct load control

30,000 potential monitor/control points

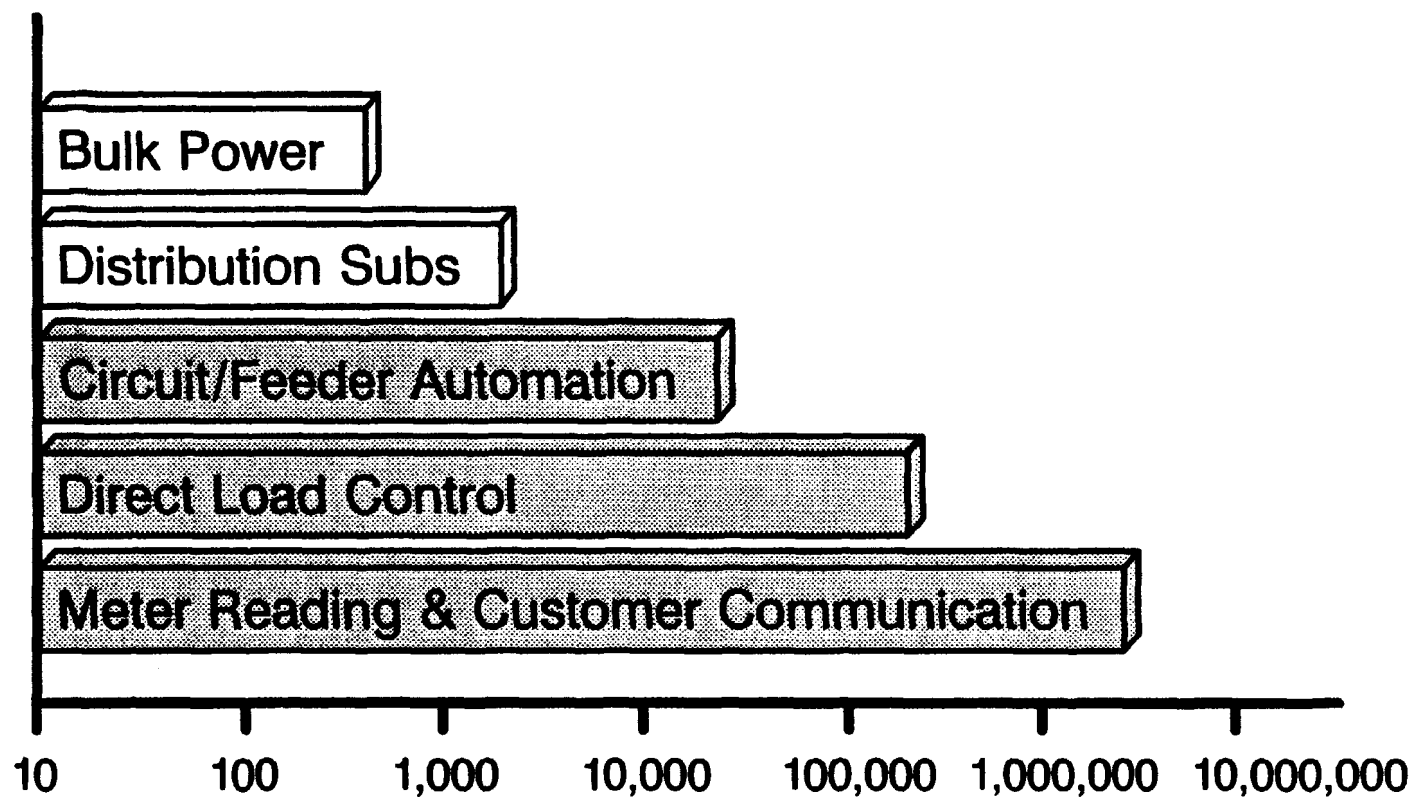
600 meter readers

50 cents/month meter reading costs

NETCOMM

SCE's Electrical System Communications

Number of Points



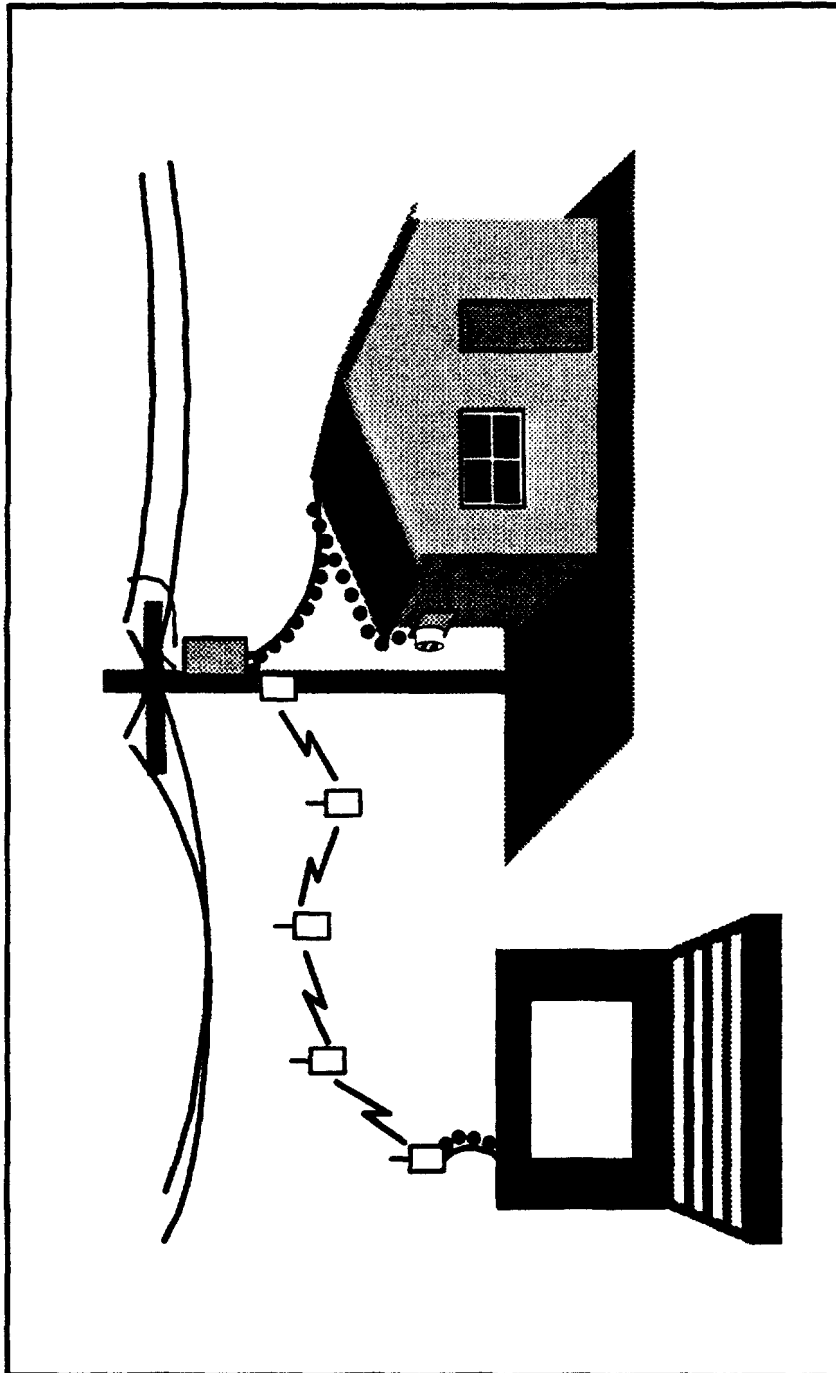
NETCOMM

System Requirements

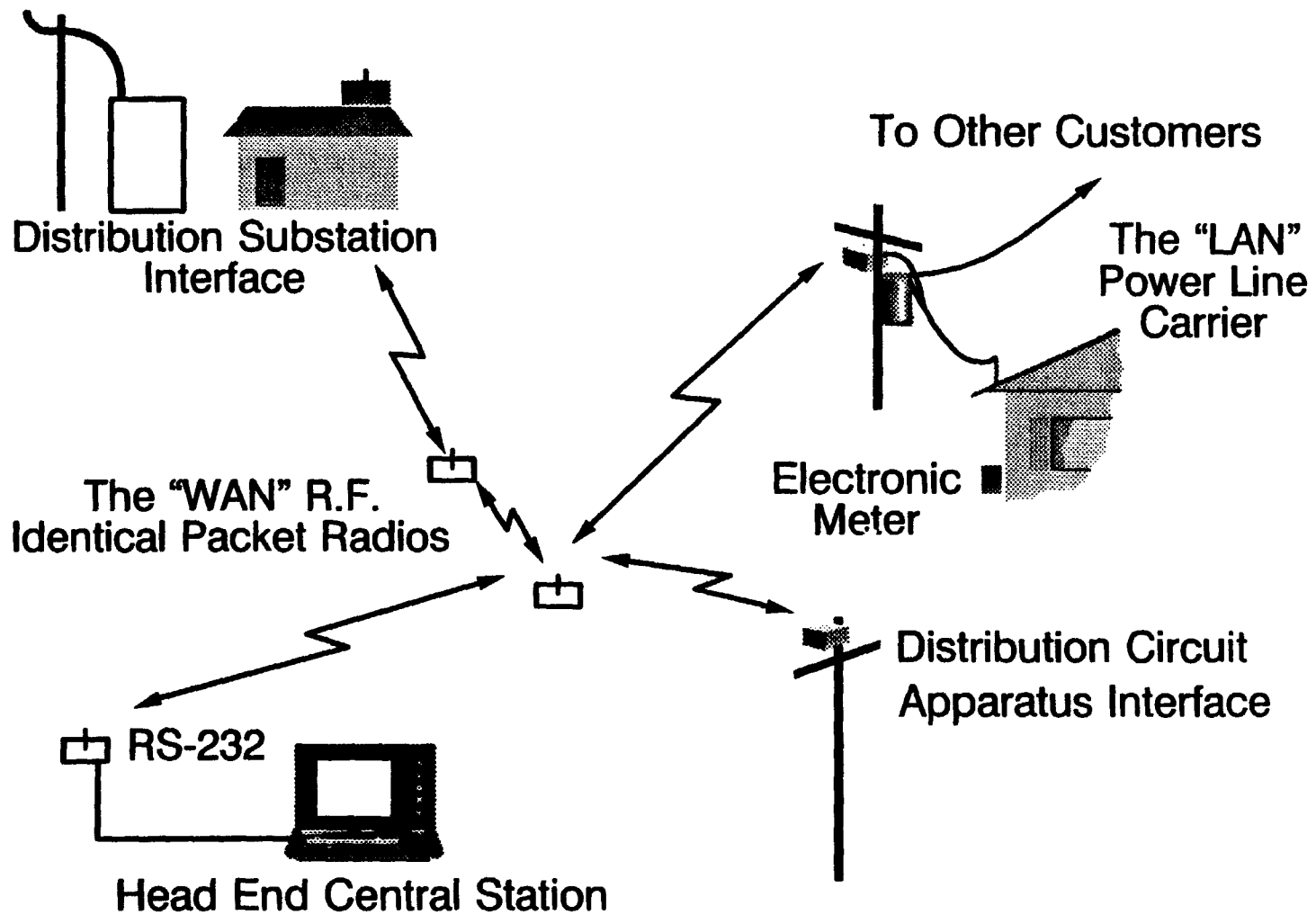
- Communication
 - Two-way
 - Point to point and broadcast
 - High transaction rate
 - Reliable
 - Error free
 - Secure
 - "Dead-line" communication
- Easy installation, expansion, and maintenance
- Large number of end-points
- End-to-end utility control
- Multi-user access
- Interface with existing systems

NETCOMM

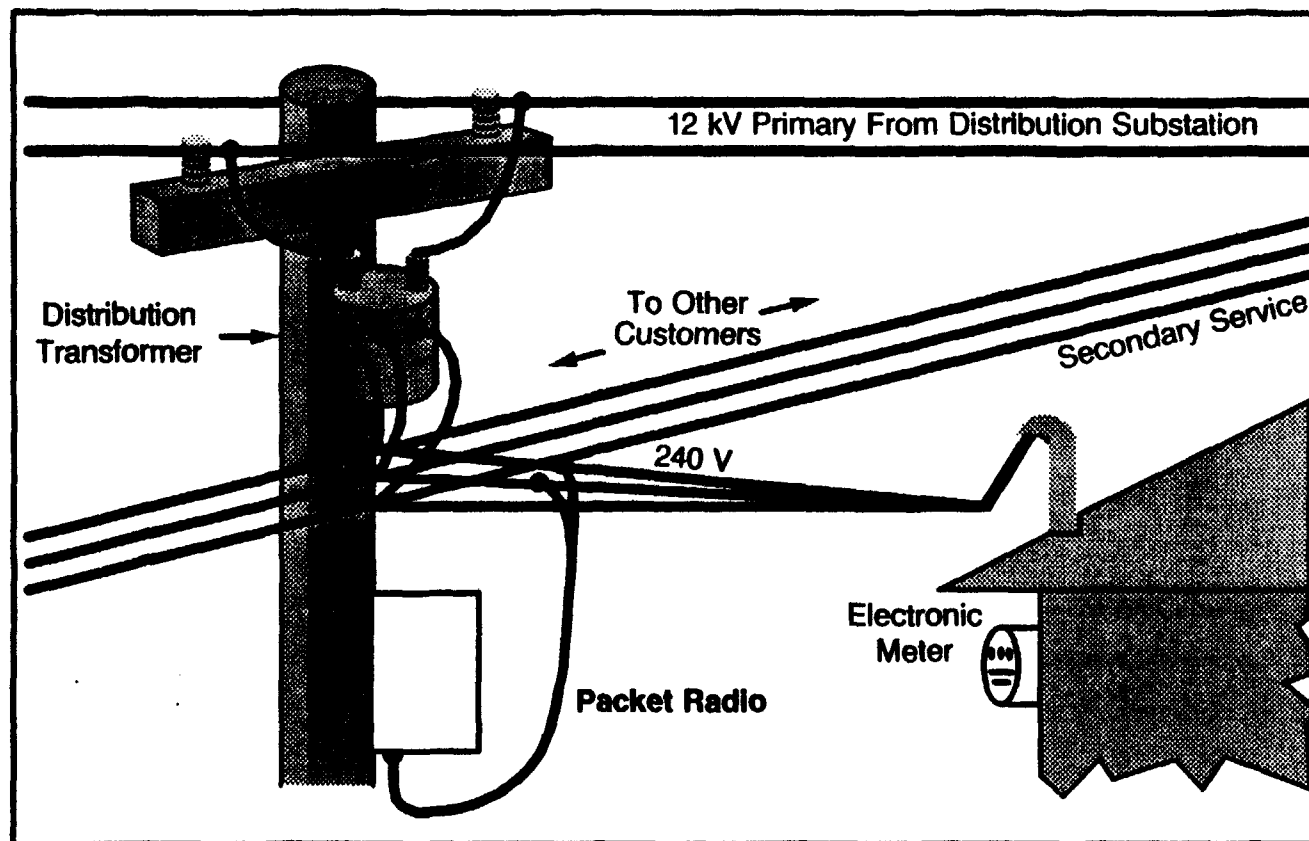
BASIC COMMUNICATION CONCEPT



MULTIPLE USES FOR WIDE AREA NETWORK (WAN)

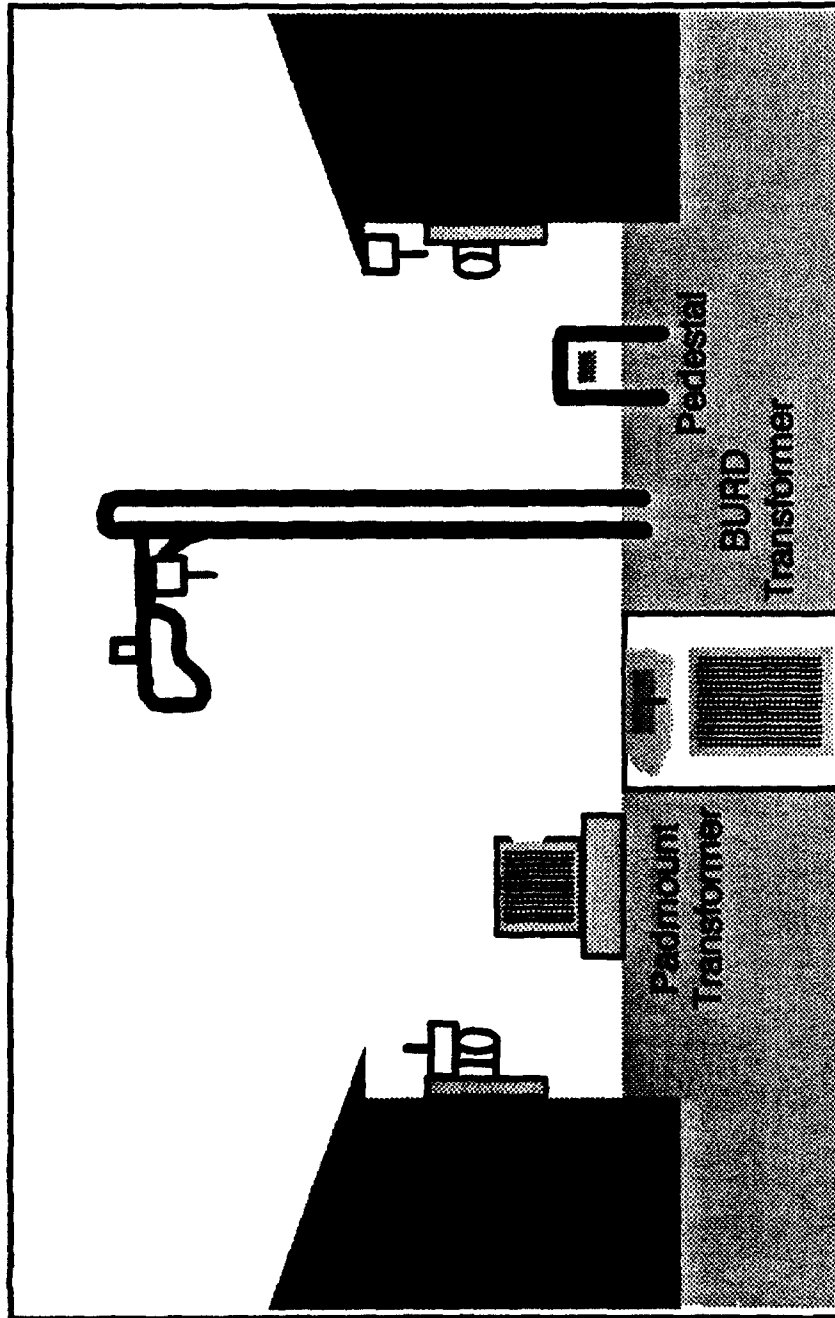


**TYPICAL PACKET
RADIO INSTALLATION FOR OVERHEAD CONSTRUCTION**



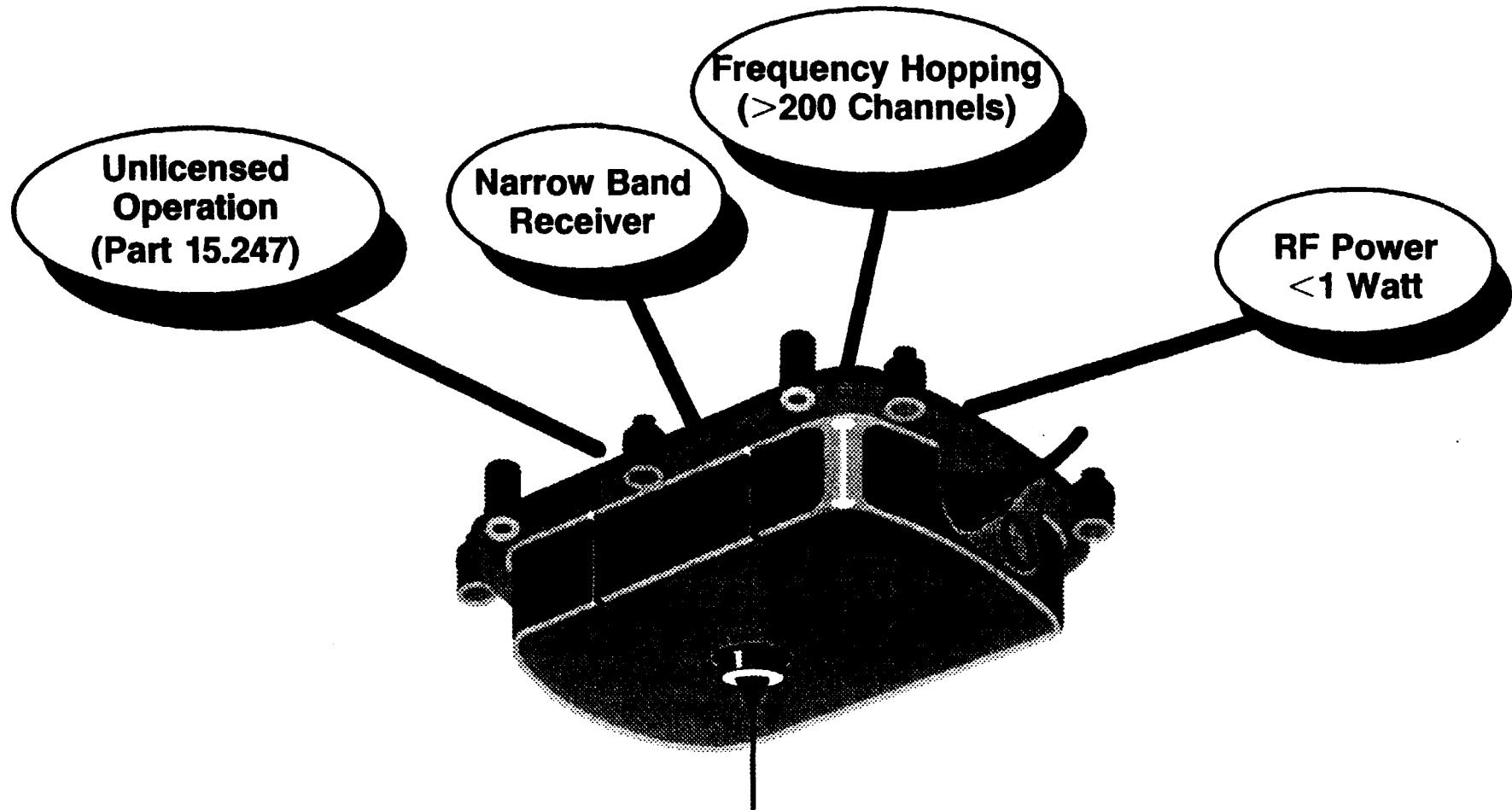
NETCOMM

Underground Service Area



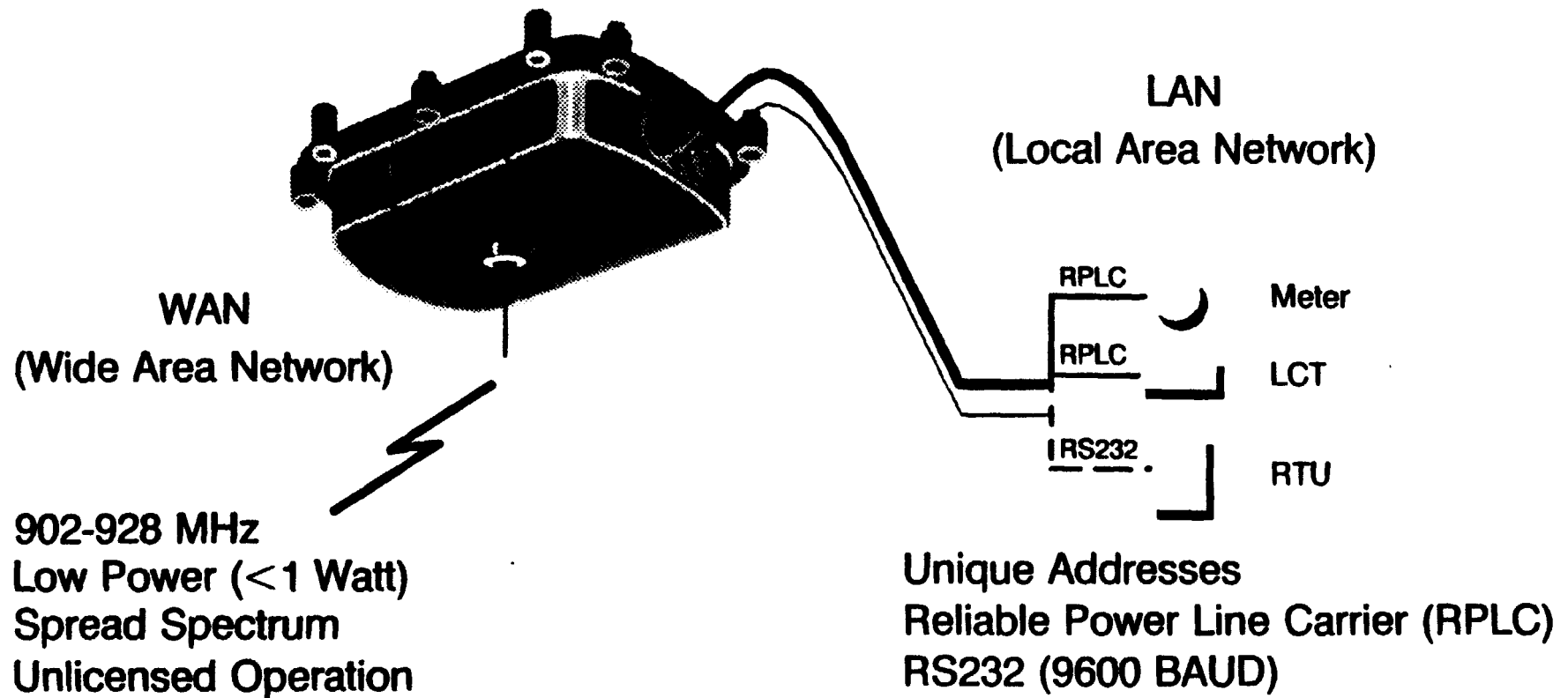
NETCOMM

Spread Spectrum Specification



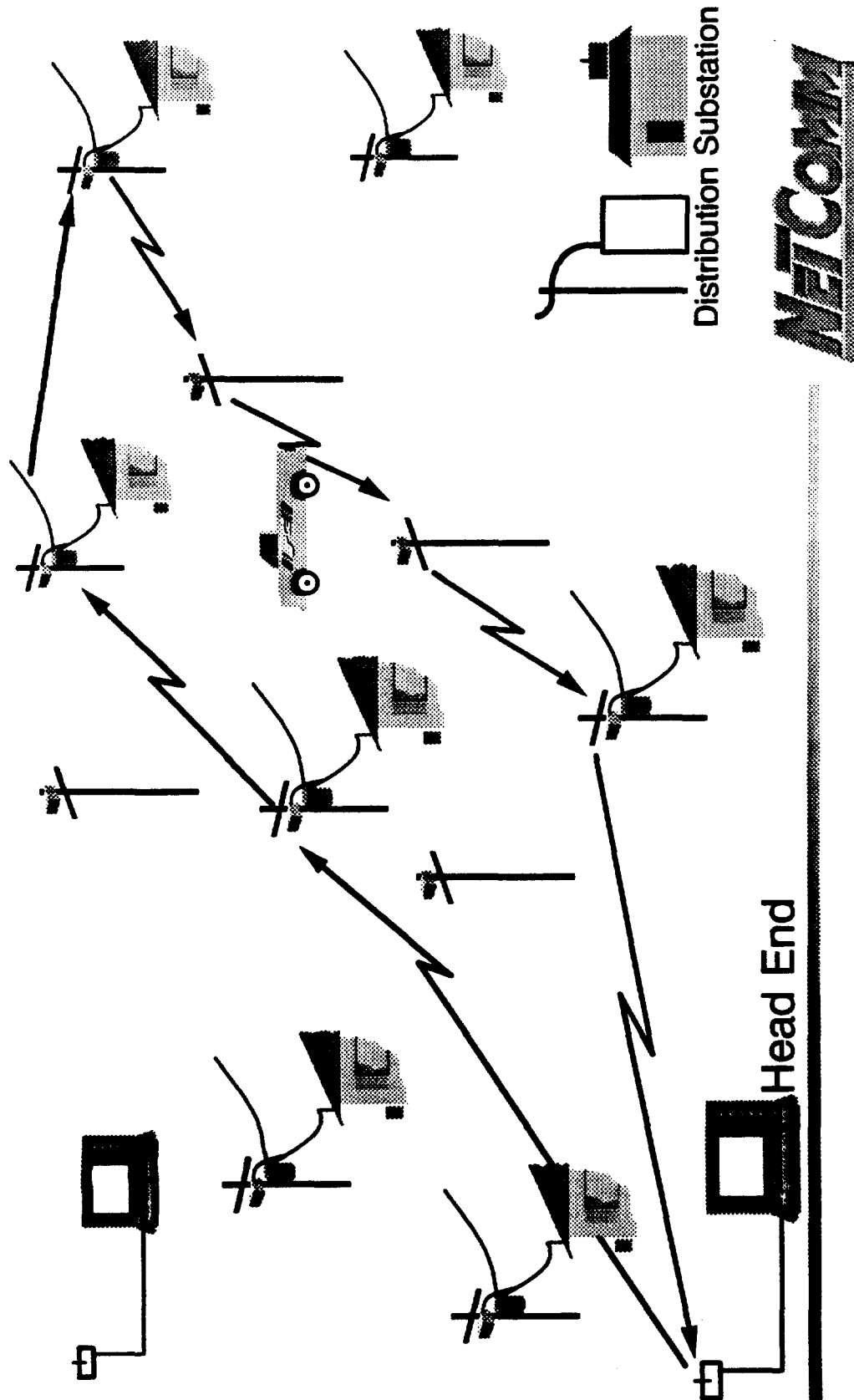
NETCOMM

Communication Gateway

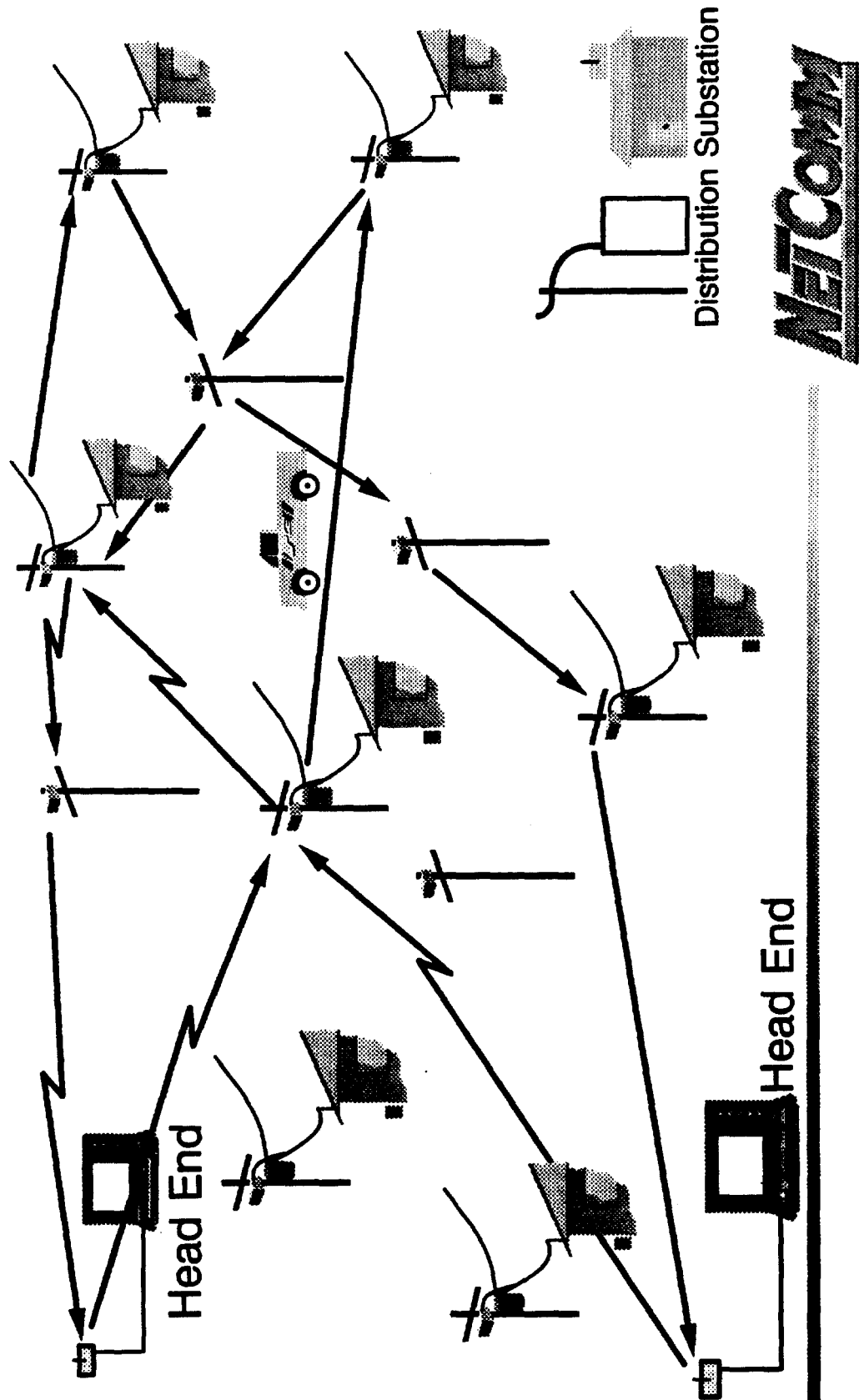


NETCOMM

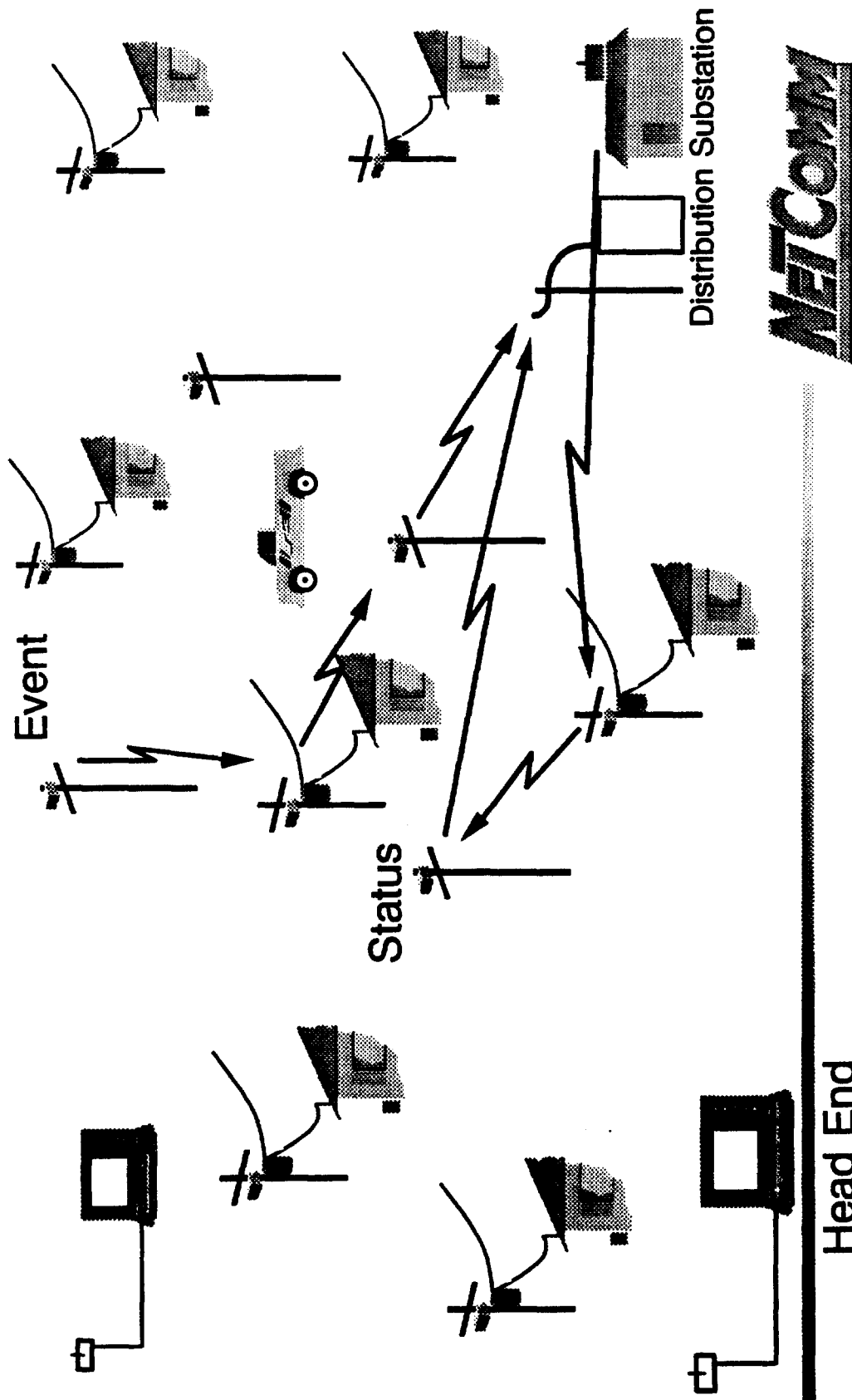
Remote Meter Reading



Multiple Head Ends



Distribution System Automation



Mobile Communications

